imaging, carotid duplex ultrasound criteria, and ultimately, threshold for surgery. We sought to identify national variation in preoperative imaging, duplex ultrasound criteria, and surgical intervention threshold for asymptomatic CEA.

Methods: The Society for Vascular Surgery Vascular Quality Initiative (VQI) database was used to identify all CEA procedures performed for asymptomatic carotid artery stenosis between 2003 and 2014. VQI currently captures 100% of CEA procedures performed at >270 centers by >2000 physicians nationwide. Three analyses were performed to quantify the variation in 1) preoperative imaging modality, 2) duplex ultrasound criteria, and 3) degree of stenosis threshold used for CEA.

Results: Of 35,695 CEA procedures in 33,488 patients, 19,610 (55%) were performed for asymptomatic disease. The preoperative imaging modality varied widely, with 53% of patients receiving a single imaging study (duplex ultrasound, 41%; computed tomography angiography, 8.3%; magnetic resonance angiography, 2.5%; cerebral angiography, 1.1%) and 47% receiving multiple preoperative imaging studies. Of the 16,997 asymptomatic patients (87%) who underwent a preoperative duplex ultrasound study, there was significant variability between centers in the degree of stenosis (50%-69%, 70%-79%, 80%-99%) designated for a given peak-systolic velocity, end-diastolic velocity, and internal carotid artery/common carotid artery ratio. Although asymptomatic CEA procedures were performed in 68% of patients for an 80% to 99% stenosis, 26% were for a 70% to 79% stenosis, and 4.1% were for a 50% to 69% stenosis. At the center level, institutions range in the percentage of CEA procedures performed for a <80% asymptomatic carotid artery stenosis from 2.8% to 86%. At the surgeon level, surgeons ranged from 0.6% to 88% in the percentages of CEA procedures performed for a <80% asymptomatic carotid artery stenosis from 0.6% to 88%.

Conclusions: Despite CEA being an extremely common procedure, there is widespread variation in the three primary determinants—preoperative imaging, duplex ultrasound criteria, and treatment threshold—of whether CEA is performed for asymptomatic carotid stenosis. The observed variation likely has significant downstream effects that influence health care quality and health care costs, which may be improved with increased standardization of care.

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A New Era in Vascular Surgery Inpatient Care: Results of a Vascular Surgeon-Hospitalist Comanagement Service

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Objectives: Vascular surgery patients have increased medical comorbidities that amplify the complexity of care. We aim to assess the effect of a hospitalist comanagement service (HCS) on inpatient vascular surgery outcomes.

Methods: A total of 1059 patients were divided into two cohorts for comparison: 515 between January 2012 and December 2012 before the implementation of an HCS, and 544 between January 2013 and October 2013 after the initiation of an HCS. Nine vascular surgeons and 10 hospitalists participated in the HCS. End points measured were in-hospital mortality (IHM), length-of-stay (LOS), 30-day readmission rates (RAR), 0 to 10 visual analog scale pain scale scores, in-patient adult safety assessments using the Agency for Healthcare Research and Quality (AHRQ) Patient Safety Indicators (PSI), and resident perceptions assessed by survey.

Results: The IHM rate decreased from 1.75% to 0.37% after the implantation of the HCS ($P = .016$), with a decrease in the observed-to-expected (O/E) ratio from 0.89 to 0.22. The risk adjusted IHM decreased from 1.56% to 0.0008% ($P = .003$). Mean LOS was lower in the base period, 5.1days vs 5.5 days ($P < .001$), with an O/E ratio of 0.83 and 0.78, respectively. The risk adjusted LOS increased from 4.2 days to 4.3 days ($P < .001$). The overall 30-day RAR was unchanged, 23.1% compared with 22.8% ($P = .6$). The related 30-day RAR was also similar, 11.5% compared with 11.4% ($P = .5$). Patients reporting no pain during hospitalization increased from 72.8% before the HCS to 77.8% after ($P = .04$). Reports of moderate pain decreased from 14% to 9.6% ($P = .016$). Mild and severe pain scores were similar between the two groups. Adult safety measured by AHRQ demonstrated a decrease in the number of deaths among surgical patients with treatable complications from 3 to 0 patients ($P = .04$). Most house staff reported that the comanagement program had a positive effect on patient care and education.

Conclusions: The hospitalist comanagement service resulted in a significant decrease in in-hospital mortality rates, improved patient safety as measured by AHRQ, and lower pain scores. Resident surveys demonstrated perceived improvement in patient care and education. Continued observation will be necessary to assess the long-term effect of the HCS on quality metrics.

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Improved Access to Health Care in Massachusetts After 2006 Massachusetts Healthcare Reform Is Associated With a Significant Decrease in Mortality Among Vascular Surgery Patients

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Objectives: Timely access to care is directly impacted by insurance coverage and affects outcomes after vascular procedures. We evaluated trends of in-hospital mortality (IHM) for index vascular procedures so as to assess the effects of 2006 Massachusetts (MA) Healthcare Reform (MHR) on the mortality trends.

Methods: National Inpatient Sample (2003-2011) was queried to identify surgical patients with peripheral arterial disease, carotid stenosis, and abdominal aorta aneurysm based on International Classification of Diseases, Ninth Revision, Clinical Modification diagnostic and procedure codes. The cohort was then divided into MA and non-MA (NMA) based on the location of the hospital. Two time intervals, 2003-2006 (P1) and after 2006 (P2) were selected for comparisons. The patients at MA and NMA hospitals were described in terms of demographic characteristics and presentation by time interval (P1 vs P2) and compared using χ^2 and t-test. Weighted logistic regression with a term modeling change in the odds ratio for second time interval was used to test and estimate trends in mortality and to compare MA and NMA trends.

Results: We identified 306,438 patients operated on for peripheral arterial disease, carotid stenosis, and abdominal aortic aneurysm. MA and NMA cohorts were similar, with a significant increase in Elixhauser

Table. Annual change in in-hospital mortality after vascular operations

Contrast	*OR*	*95% CI*	P *value*
Overall annual change	0.93	0.90-0.97	<.001
2003-2006 (P1)	0.95	0.93-0.97	<.001
2007-2011 (P2)	1.02	0.96-1.08	.569
P2 vs P1			
MA annual change	1.05	0.85-1.29	.648
P1	0.78	0.67-0.91	.001
P2	0.74	0.56-0.99	.043
P2 vs P1			
Non-MA annual change	0.93	0.90-0.97	<.001
P1	0.95	0.93-0.98	<.001
P2	1.03	0.97-1.09	.405
P2 vs P1			
MA vs Non-MA (P1)	1.13	0.92-1.39	.26
MA vs Non-MA (P2)	0.82	0.70-0.95	.01

CI, Confidence interval; *MA*, Massachusetts; *OR*, odds ratio.

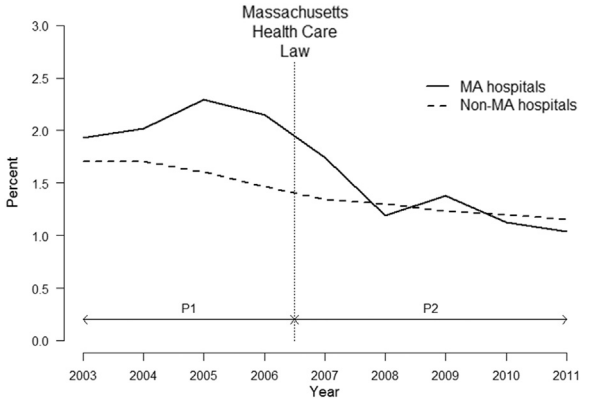

Fig. Mortality (moving average).

comorbidity index in P2 (vs P1) in both cohorts ($P < .001$). Mortality trends are depicted in Fig 1. There was a significant decline in IHM for all vascular patients during both time intervals, although no significant difference in the rate of decline was noted (Table). There was no significant difference in IHM trends in P1 between MA and NMA; however, a significantly higher decrease in IHM was noted in MA compared with NMA in P2 (the annual odds ratio of IHM differed by 18%; $P = .010$).

Conclusions: Overall, a significant decrease in IHM for all vascular procedures was noted in the United States. The decline in postoperative IHM was significantly more rapid in the MA sample after 2006 compared with the NMA sample. This study suggests that better access to care in Massachusetts may be a cause of this decline in IHM.

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Integrated Vascular Surgery Residency: A Look at Electronic Residency Application Service Applicant Numbers and National Residency Matching Program Match Outcomes

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Objectives: In 2007 the Accreditation Council for Graduate Medical Education granted accreditation to three vascular surgery integrated residencies. This number grew to 44 programs offering 51 positions by the 2014 match. In this study, we sought to identify the top U.S. domestic medical schools guiding seniors into 0+5 vascular surgery programs and ascertain which characteristics of their faculty and curriculum might be responsible for fostering this interest.

Methods: Every U.S. medical school and its associated surgery department was queried between January 2 and February 26, 2014. Among the 21 data points collected were specialty of the surgery department chair, number of vascular surgeons on staff, and option for a third-year vascular surgery (VS) clerkship. Electronic Residency Application Service (ERAS) and National Residency Matching Program databases were accessed and queried. Data regarding number of integrated vascular applicants from each medical school was obtained by special request directly from ERAS.

Results: Between 2007 and 2014, 505 students applied to an integrated vascular residency via the National Residency Matching Program (Table), whereas ERAS reported 1476 applicants during the same time period. Of the 138 U.S. medical schools, 119 (86%) had at least one graduating senior apply through ERAS to a vascular 0+5 program. U.S. graduating seniors from the top 10 schools provided 21% (107 of 512) of the total applicants during these years. The presence of an integrated training program ($P = .005$) and a VS clerkship ($P < .05$) correlated with a higher number of applicants to 0+5 programs. Conversely, having a vascular surgeon as the department head for general surgery was a negative predictor of student applications to 0+5 vascular programs (odds ratio, 0.15; 95% confidence interval, 0.04-0.56; $P = .005$).

Conclusions: This study emphasizes the need to foster medical student interest in vascular surgery through formal VS clerkships, mentorship, and targeting information about the 0+5 pathway to schools producing a lower number of applicants. The negative correlation between integrated vascular applicants and vascular surgeons serving as general surgery department chairs may be related to the latter's preference for the traditional 5+2 pathway.

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Staged Hybrid Repair of Extensive Thoracoabdominal Aortic Aneurysms Secondary to Aortic Dissections: Midterm Outcomes

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Objectives: Open repair of Crawford extent I/II thoracoabdominal aortic aneurysms (TAAA) is associated with a high rate of major adverse complications. Staged hybrid repair of these extensive TAAAs may reduce this operative risk. In the present study, we reviewed the midterm outcomes of a previously described technique that combines proximal thoracic endovascular aneurysm repair (TEVAR), followed by staged distal open thoracoabdominal repair for patients with Crawford extent I/II TAAAs.

Methods: From July 2007 to June 2014, 19 patients with Crawford extent I (n = 1) or extent II (n = 18) TAAAs secondary to chronic aortic dissections underwent a staged hybrid repair. All patients had TEVAR as stage 1 and open repair as stage 2, with partial cardiopulmonary bypass via left femoral arterial and venous cannulation for visceral and lower body perfusion. The open thoracoabdominal graft was anastomosed proximally in end-to-end fashion with the endograft.

Results: Patients (14 males) were an average age of 54 ± 17.6 years. Nine patients had prior open proximal aortic surgery for type 1 aortic dissections. TEVAR was performed via percutaneous (n = 8), femoral cutdown (n = 8), or iliac exposure (n = 3). The left subclavian artery was covered in nine patients and revascularized in eight patients by carotid-subclavian bypass (n = 7) or laser fenestration (n = 1). There were no deaths, strokes, or paralysis in this cohort. After TEVAR, three patients required repeat intervention for endoleak (type IA, n = 1; type IB, n = 1; type II, n = 1) before open repair. After open repair, there was a single delayed permanent paralysis. Hospital length of stay was 7 ± 4 days after TEVAR and 9 ± 5 days after open repair. No deaths or neurologic events occurred in the remaining 18 patients over a median 85-week follow up (range 4 weeks-6.2 years). Importantly, all patients had a stable aortic size and remained free of reintervention during the follow-up period (Table).

Conclusions: Staged hybrid repair, combining proximal TEVAR with open distal repair, for extensive TAAAs secondary to chronic dissection is an effective, durable, and safe alternative to traditional open repair. This midterm follow up data suggests that staged repair may reduce perioperative morbidity and mortality in patients with extensive TAAAs.

Table. Outcome of staged hybrid repair of extent I/II thoracoabdominal aortic aneurysms (TAAAs)

Outcome	*Staged hybrid repairs (N = 19), No. (%)*
Stage 1: TEVAR	
Death	0 (0)
Stroke/paraplegia	0 (0)
Acute kidney injury	1 (5.2)
Type I endoleak	2 (10.5)
Type II endoleak	1 (5.2)
Stage 2: Open distal repair	
Death	0 (0)
Stroke/paraplegia	1 (5.2)
Acute kidney injury[a]	5 (26.3)
Chronic renal failure	0 (0)

TEVAR, Thoracic endovascular aneurysm repair.
[a]Serum creatinine >2 mg/dL.

Table. Number of applicants from 2007-2014 participating in 0+5 National Residency Matching Program match

Year	*Programs (No.)*	*Positions (No.)*	*Positions filled (No.)*	*Total App. (No.)*	*U.S. Grad App. (No.)*	*IM Grad App. (No.)*	*App. per position (No.)*	*U.S. Grad App. per position (No.)*
2007	3	4	4	N/A	N/A	N/A	N/A	N/A
2008	7	9	9	31	21	10	3.4	2.3
2009	17	19	19	66	32	34	3.5	1.7
2010	20	22	21	72	39	33	3.3	1.8
2011	27	30	29	80	47	33	2.7	1.6
2012	35	41	41	82	55	27	2.0	1.3
2013	39	46	45	84	49	35	1.8	1.1
2014	44	51	46	90	48	42	1.8	0.9

N/A, Not applicable.